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***Abstract*:** A 2430 ha prescribed burn was conducted on Malheur National Wildlife Refuge, Harney County, Oregon in March 1985. About 35 days later, 11 greater sandhill crane (*Grus canadensis tabida*) pairs nested within the burned area; 9 of these hatched. The remaining 2 clutches were destroyed by coyotes (*Canis latrans*). Crane hatching success was significantly higher ($P = 0.01$) on the burned area (81.8%) than elsewhere (38.5%). Two factors were likely responsible for the higher success rate in the burn; nests were placed in deeper water and the small mammal prey base was temporarily reduced or eliminated resulting in reduced predator activity during incubation. Although hatching success was high for the burned area, no young fledged, probably because of increased predator pressure by late May.

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An area of interspersed, seasonally flooded wetlands and shrub-covered uplands was burned on 30 March 1985 on Malheur National Wildlife Refuge (Malheur NWR), in southeastern Oregon. The burn area included about 2,430 ha of which 2,227 burned. Most of the unburned 200 ha area was black greasewood (*Sarcobatus vermiculatus*) flats with limited fine fuels. Previous prescribed burns at Malheur NWR were small (<250 ha) and little information was collected on breeding greater sandhill crane responses to fire and subsequent nesting success. However, most pairs moved to adjoining unburned sites (Littlefield unpublished data). Although only 4 nests were monitored at previous burns, predators destroyed 3 and 1 was flooded. Predators remaining on or near unburned sites consistently hunted the small burned plots. During the March 1985 fire, greater sandhill crane breeding territories located in marsh-meadow habitats were >95% burned. In this paper we report responses of nesting pairs and their nesting success in an extensive area of habitat burned in the spring.

STUDY AREA AND METHODS

The burned area's northern boundary was about 20 km south-southeast of Malheur NWR headquarters (51 km SSE of Burns, Harney County, Oregon, 43° 35'N, 118° 57'W) and extended south for 6.5 km. The width of the burn varied from 2 km on the south to 4.8 km on the north. The West Canal and Donner und Blitzen River delineated the western and eastern burn boundaries, respectively. Within the area, meadows vegetated with various grass and sedge (*Carex* spp.) species dominated, whereas coarse emergents composed mostly of hardstem bulrush (*Scirpus acutus*), broad-fruited burreed (*Sparganium eurycarpum*), and common cattail (*Typha latifolia*) grew in depressions, ponds, sloughs, and channels. Interspersed among the wetland complex were extensive uplands vegetated with either big sagebrush (*Artemisia tridentata*), rabbitbrush (*Chrysothamnus* spp.), and/or greasewood. Irrigation by flooding began in April, and wetlands remained flooded through most of July. Grasses and sedges were burned within 1 to 8 cm of the soil substrate. A few scattered residual bulrush stands (usually <3 m diam.) remained intact unburned in the area.

The area was searched for crane nests on the ground during 6 May–6 June 1985. All nests were marked with laths at distances from 29–67 m. When a nest was found, incubation stage was determined by flotation (Westerskov 1950), and concealment category (Littlefield 1995*a*), vegetative type, water depth, and clutch size were recorded. Nests were revisited to assess clutch fates after expected hatching dates.

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The traditional method, or apparent estimator (ratio of number of clutches that hatched to number found) was used for determining nest success, as both terminated and active nests had an equally high probability of being located (Johnson and Shaffer 1990). We used a t-test to compare mean water depths at nest sites in the burned area with mean water depths at nests outside the burn. Differences in nesting success between burned and unburned sites were tested with 2 x 2 contingency tables applying Yates correction for continuity (Sokal and Rohlf 1969).

RESULTS

Seventeen known crane nesting territories were in the area that burned. Of these, 11 (64.7%) pairs built nests within the burn area even though nesting cover was severely limited. Four nests were in the southwest, 6 in the west-central, and 1 in the northwest portion of the burn. Six other pairs that had territories along the eastern edge shifted east and nested in adjacent unburned wetlands. Pairs with breeding territories in the western portion did not have this option, because the west boundary was bordered by the shrub-covered slopes of the Jackass Mountains. Crane nest locations were mostly in or near small and isolated patches of unburned vegetation.

Eight of 11 (72.7%) nests were in hardstem bulrush, 2 (18.2%) in common cattail, and 1 (9.1%) in broad-fruited burreed. Most nests were in small stands of standing or burned emergents that provided limited concealment. Concealment was classified as poor for 9 (81.8%), fair for 1 (9.1%), and good for 1 (9.1%). The only nest with good concealment was in a long, narrow channel with unburned bulrush.

Crane nests within the burn were over deeper water than nests elsewhere on Malheur NWR in 1985 ($t = 3.61$, 46 df, $P < 0.01$). Water depths ranged from 10.4–62.5 cm ($\bar{x} = 42.4$ cm, SD = 15.0). Water depths for 39 nests in unburned locations ranged from moist soil to 64.5 cm ($\bar{x} = 23.6$ cm, SD = 14.2).

Nine of 11 (81.8%) clutches hatched; the other 2 were depredated by coyotes. All nests contained 2 eggs, and in the successful nests all eggs except 1, that was infertile, hatched; fertility rate was 94.4%.

Most nesting was initiated during 1–7 May, shortly after breeding territories became flooded. One clutch each in cattail and bulrush was destroyed; both were poorly concealed. Nest success was significantly greater ($\chi^2 = 6.46$, 1 df, $P = 0.01$) than success outside the burn. Success of 39 nests assessed elsewhere on Malheur NWR in 1985 was 38.5%; 1 clutch was abandoned and 23 were lost to predators. Coyotes destroyed 15 (38.5%), common ravens (*Corvus corax*) 7 (17.9%), and raccoon (*Procyon lotor*) 1 (2.6%).

DISCUSSION

Two factors may have been responsible for higher crane nest success within the burn: (1) nest placement was in deeper water, and (2) the small mammal prey base was temporarily reduced or eliminated. The cause for pairs nesting in deeper water was attributed to standing residual vegetation; many of the deeper marshes were moist at the time of the burn, resulting in a few small emergent patches surviving the fire. Coyotes in particular have a tendency to avoid crane nests in deep water on Malheur NWR (Littlefield 1995*a*). However, this would not account for the lack of predation by the other 2 important egg consumers, common raven and raccoon. Therefore, we assume that a reduction of small mammal prey caused predators to temporarily leave. Small mammals, especially montane voles (*Microtus montanus*), are an important food source for coyotes at Malheur NWR, particularly before avian species start to nest (unpublished data).

Coyotes had returned to the burn by late May and no young cranes were known to fledge. On 23 May 1985, a crane chick called from a dense new growth Baltic rush (*Juncus balticus*) stand in the burn area. Upon leaving the site, one of us (Littlefield) nearly collided with 2 coyotes as they rapidly approached the calling chick over a dike. Nearby, another coyote was close to a crane pair with 2 chicks. The pair began to perform distraction displays (feigning), at which time the coyote initiated hunting behavior. Littlefield's presence, however, resulted in the 3 coyotes quickly leaving. A survey on 27 May revealed no crane pairs or chicks, indicating all chicks had been lost, apparently to predation.

Vogl (1980 unpublished) suggested that little was known about the affects of fire on western alkaline marshes because of (1) the limited burning in the region and (2) the minimal effort by marsh managers to study, record, and publish results from their prescribed burns. However, studies on the effects of fire on small mammal populations was documented at Malheur NWR by Cornely et al. (1983), but generally there has been little documentation on the relationships of fire and other Great Basin wetland species. The purpose of this study was to report the impacts of a large prescribed wetland burn and its effects on crane reproductive success in a region known for high predation rates and excessive predator populations (Littlefield 1976, 1995*a,b*). We found that large prescribed burns may perhaps be a useful vegetation management strategy, at least for wetlands inhabited by breeding greater sandhill cranes. Although we recorded higher nesting success, it did not contribute to successful fledging during the same year as the burn. Comparisons with success in succeeding years was not feasible, as an intensive predator control program initiated in 1986 would have made comparisons biologically meaningless.

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